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ATTACHMENT TO A PATENT APPLICATION

DOCKET NO.: 6006-150-1

ENTITLED: SEAM CLOSING APPARATUS

INVENTOR(S): John J. Toben and Michael C. Borwig

INCLUDING: Specification; Claims; Abstract; and 12 sheets of Informal Drawings

SEAM CLOSING APPARATUS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application Serial No. 60/412,723, filed on September 23, 2002, herein incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] This invention relates in general to a seam closing apparatus, and deals more particularly with a seam closing apparatus, which is capable of closing seams in ductwork via one pair of closing rollers.

BACKGROUND OF THE INVENTION

[0003] Rectangular or box-shaped ducts are extensively utilized in heating and ventilating systems to distribute heated or cooled air throughout a structure. These ducts are commonly formed from differing gauges of sheet metal in sections of predetermined lengths, which are then connected to one another to form a continuous duct for distributing air.

[0004] Typically, each section of duct is formed by bending two pieces of sheet metal of the desired length at a 90° angle. One edge of each piece is formed to include a longitudinally extending groove, forming thereby the female portion of the seam, while the other longitudinal edge of each piece is bent over along its length to form thereby the male portion of the seam. The two pieces are then assembled by inserting the male portion of each piece into the female portion, leaving an edge extending beyond the joint from the female portion. This extended edge must then be bent over to lock the seam. One industry standard example of such a seam is a 'Pittsburgh' lock or seam.

[0005] A seam closing tool is utilized to complete the sealing process by bending over the extended edge of the female portion. Known seams, such as the Pittsburgh seam, include an extended edge which extends approximately perpendicularly to its final, sealed position. Consequently, the seam closing tool

must employ a plurality of rollers to gradually bend, or form, the extended edge over to its final sealed position, each of the plurality of rollers bending the extended edge over to a greater degree until the final sealing position is attained. It is also known to utilize either a manual or pneumatically actuated hammer to bend or form over the extended edge of the female portion.

[0006] While these known sealing systems are successful to a degree, they suffer from several logistical problems. Firstly, the multi-roller seam closing tool cannot completely seal the entire length of a given seam at those locations adjacent the end of the seam. This inability to completely seam the length of the seam is due to the graduated sealing angles inherent in each of the plurality of rollers of the seam closing tool. That is, it is the last of the rollers which has the most severe sealing angle and accomplishes the final sealing operation of the seam closing tool, however the last roller is preceded by all of the other rollers and, therefore, will not be permitted to reach or affect the last few feet or inches of the seam. Hammering will thus be necessary to finish the complete seal of the seam.

[0007] Similarly, the manual or pneumatic hammering of the seam in its entirety is highly labor intensive and quite loud, oftentimes requiring ear protection for the operators who assemble the finished duct work. Moreover, the time and effort extended on hammering the extended edge of the female portion over to seal the seam, can substantially increase the time and expense of any duct fabrication and installation job, typically by as much as 50% or more.

[0008] With the forgoing problems and concerns in mind, it is the general object of the present invention to provide a seam closing apparatus which overcomes the above-described drawbacks while maximizing effectiveness and flexibility in the assembling process.

SUMMARY OF THE INVENTION

[0009] It is an object of the present invention to provide a seam closing apparatus.

[0010] It is another object of the present invention to provide a seam closing apparatus that can be utilized along the entire length of a duct seam.

[0011] It is another object of the present invention to provide a seam closing apparatus that utilizes only a single pair of driven rollers.

[0012] It is another object of the present invention to provide a seam closing apparatus that requires no hammering to completely seal a duct seam.

[0013] It is another object of the present invention to provide a seam closing apparatus that can assuredly track the length of a duct seam.

[0014] It is another object of the present invention to provide a duct fastseam that is capable of maintaining the duct in a substantially square condition even when the fastseam has yet to be completely sealed.

[0015] It is another object of the present invention to provide a seam closing apparatus that can be operated quietly and by a single person.

[0016] These and other objectives of the present invention, and their preferred embodiments, shall become clear by consideration of the specification, claims and drawings taken as a whole.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Figure 1 is a cross-sectional view of a known duct seam.

[0018] Figure 2 is a cross-sectional view of the male and female ends of a duct fastseam.

[0019] Figure 3 is a partial cross-sectional view of a seam closing apparatus, according to one embodiment of the present invention.

[0020] Figure 4 is a partial cross-sectional view of the seam closing apparatus shown in Figure 3 as it operates upon a duct seam.

[0021] Figure 5 is a partial cross-sectional view of the seam closing apparatus as it engages the seam of a duct.

[0022] Figure 6 is a partial cross-sectional view of the operation end of the seam closing apparatus shown in Figure 3.

[0023] Figure 7 is a cross-sectional view of the operation end of the seam closing apparatus taken along lines A-A.

[0024] Figure 8 is a cross-sectional view of the operation end of the seam closing apparatus taken along lines B-B.

[0025] Figure 9 is a planar view of a seam closing apparatus, according to another embodiment of the present invention.

[0026] Figure 10 illustrates the seam closing apparatus of Figure 9 as it is first applied to a seam of a duct.

[0027] Figure 11 illustrates the seam closing apparatus of Figure 9 as it is operated to seal the outwardly extending sealing portion of the seam.

[0028] Figure 12 is a partial cross-sectional view of the seam closing apparatus of Figure 9 as it engages the seam of a duct.

[0029] Figure 13 is a partial cross-sectional view of the operation end of the seam closing apparatus shown in Figure 9.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0030] Figure 1 illustrates a cross-sectional view of a known duct seam **10**, commonly referred to in the field as a 'Pittsburgh' seam. As shown in Figure 1, the seam **10** includes a female portion **12** which is formed by repetitively bending, or roll forming, the duct material, typically sheet metal or the like, so as to form three substantially parallel folds **14**. The folds **14** serve to define a female groove **16**, wherein one of the folds **14** preliminarily extends beyond the duct edge to establish a sealing portion **18**.

[0031] The seam **10** further includes a longitudinal section of the duct wall **20** which is bent at a substantially right angle to form a male portion **22**. As will be appreciated, the male portion **22** is sized for tight fitting within the female groove **16** of the female portion **12** when fully assembled.

[0032] In operation, the male portion **22** of the seam **10** is initially fitted into the female groove **16** when the sealing portion **18** remains in its unsealed position, as represented by the dashed lines in Figure 1.

[0033] Once the male portion **22** has been inserted into the female groove **16**, the sealing portion **18** must then be hammered or otherwise bent down, in the direction of the arrow A, against the duct wall **20** in order to complete the sealing of the seam **10**. The hammering over of the sealing portion **18** is typically accomplished either manually, or with the use of a pneumatic hammer or the like. It will be readily appreciated that the hammering of the male portion **22** and the sealing portion **18** is highly time consuming and oftentimes noisy to the point of being injurious to the ears of the operators who are assembling the seam **10**.

[0034] A known, multi-roller seam closing tool may also be utilized to close the seam **10**. As shown in Figure 1, the sealing portion **18** must be bent, or formed, from its approximately perpendicular position (shown in dashed lines) to its sealed position and, therefore, a multitude of rollers are required to incrementally bend or form the sealing portion. As discussed previously, the utilization of such a multi-roller seam closing tool is unsatisfactory as manual or power-assisted hammering must still be employed to seal the last few feet or inches of the seam.

[0035] In contrast, Figure 2 illustrates the male and female portions of a fastseam **100** which is currently the subject matter of a co-pending application. As shown in Figure 2, the fastseam **100** includes a male portion **124** inserted within a groove **106** of a female portion **102**. The female portion **102** further includes a

sealing portion **120**, which will be bent in the direction of arrow B in order to seal the fastseam **100**.

[0036] Turning to Figure 3, a partial cross-sectional view of a seam closing apparatus **200** is shown, according to one embodiment of the present invention. As shown in Figure 3, the seam closing apparatus **200** includes a housing **202**, a power supply cord **204**, which may be either electrical or pneumatic in design, and an actuation trigger **206**. An operation end **208** is generally shown in Figure 3 and includes a pivot handle **210**, a drive roller **212** and a idler roller **214**. Owing partially to the configuration of the sealing portion **120** of the fastseam **100**, shown in Figure 2, the seam closing apparatus **200** is capable of completely closing the fastseam **100** along its entire length without necessitating a hammering step or the like.

[0037] Figure 4 illustrates the seam closing apparatus **200** as it is applied to the fastseam **100** of a length of duct **216**. As shown in Figure 2, when pressure is applied to the pivot handle **210** in the general direction of the arrow P, the idler roller **214** will swing upwards in the general direction of the arrow S, thus capturing the fastseam **100** between the drive roller **212** and the idler roller **214**. The drive roller **212** will thereby flatten the partially angled sealing portion **120** under force of the engagement of the idler roller **214** and the operator's downward pressure of the housing **202**.

[0038] Once the seam closing tool **200** has engaged the fastseam **100**, the operator will then actuate the trigger **206** and cause thereby the drive roller **212** to rotate in the counterclockwise direction (as seen in Figure 4), propelling the seam closing tool **200** in the direction of arrow D while flattening the sealing portion **120** to its completely sealed position. It will be readily appreciated that the pivot handle **210** may be continuously biased in the direction of arrow P by the operator during operation or, alternatively, a latch may be formed so as to hold the pivot handle **210** in its engaging position.

[0039] It is therefore an important aspect of the present invention that the seam closing tool **200** utilizes only a single, driven roller **212** to bend or form the sealing portion **120** to its completely sealed position. Moreover, by employing only a single driven roller **212** which is not preceded by a plurality of additional, incremental rollers, the seam closing apparatus **200** of the present invention will permit the driven roller **212** to transverse and seal the entirety of the fastseam **100** without requiring the additional time, expense and audible discomfort of a hammering operation.

[0040] Figure 5 illustrates an end view of the seam closing apparatus **200** as it is engaged with the fastseam **100**. As shown in Figure 5, the idler roller **214** includes an annular groove **218** which serves to receive the lower bend **220** (also shown in Figure 2) of the fastseam **100**, thereby ensuring a secure lock upon, and tracking of, the fastseam **100** as the seam closing apparatus **200** is driven down the length of the fastseam **100**.

[0041] It should also be noted that the driven roller **212** includes an angled profile **222** such that, as shown in the cross-sectional view of Figure 5, the circumference of the driven roller **212** is smaller in the area adjacent the seam closing apparatus **200** than it is at the exterior side **224** of the driven roller **212**. In this manner, the eccentrically formed driven roller **212** ensures a tight seal of the sealing portion **120** against the duct wall **216**.

[0042] Figure 6 illustrates a partial cross-sectional side view of the operation end **208** of the seam closing apparatus **200**. Figure 7 illustrates the section A-A taken through the operation end **208**, while Figure 8 illustrates the section B-B taken through the operation end **208**.

[0043] While the seam closing apparatus **200** has been described as including a pivot handle **210** and a displaceable idler roller **214**, the present invention is not limited in this regard. Alternative embodiments of the present invention are envisioned to include a seam closing apparatus having no pivot handle **210**, having instead only an idler roller which is fixed in position with respect to the

driven roller **212**. In this embodiment, an operator need only depress the driven roller **212** onto the sealing portion **120** until the groove **218** of the idler roller is capable of latching onto the lower bend **220** of the fastseam **100**.

[0044] Turning to Figure 9, a side plan view of a seam closing apparatus **300** is shown, according to another embodiment of the present invention. As shown in Figure 9, the seam closing apparatus **300** includes a housing **302**, a power supply cord **304**, which may be either electrical or pneumatic in design, and an actuation trigger **306**. An operation end **308** is generally shown in Figure 9 and includes a drive roller **310**, a idler roller **312** and a raised abutment surface **314**. Owing partially to the configuration of the sealing portion **120** of the fastseam **100**, shown in Figure 2, the seam closing apparatus **300** is capable of completely closing the fastseam **100** along its entire length without necessitating a hammering step or the like.

[0045] Figure 10 illustrates the seam closing apparatus **300** as it is first applied to the fastseam **100** of a length of duct **216**. As shown in Figure 10, the seam closing apparatus **300** is applied to the fastseam **100** in a vertical orientation, bringing the drive roller **312** into contact with the sealing portion **120** of the fastseam **100**. As will be discussed in more detail later, the idler roller **312** includes a groove formed thereon to accommodate the bottom edge of the fastseam **100**.

[0046] Once engaged with the fastseam **100**, pressure is applied to the fastseam **100** by rotating the seam closing apparatus **300** in the general direction of the arrow X, as shown in Figure 11. Actuation of the trigger **306** then causes drive roller **310** to rotate, thus flattening the partially angled sealing portion **120** captured between the drive roller **310** and the idler roller **312**.

[0047] The drive roller **310** will rotate in the clockwise direction (as seen in Figures 10 and 11), propelling the seam closing tool **300** in the direction of arrow Z while flattening the sealing portion **120** to its completely sealed position. It

will be readily appreciated that fastseams of varying dimensions may be accommodated via an appropriate rotation of the housing **302**.

[0048] It is therefore an important aspect of the present invention that the seam closing tool **300** also utilizes only a single, driven roller **310** to bend or form the sealing portion **120** to its completely sealed position. Moreover, by employing only a single driven roller **310** (which is not preceded by a plurality of additional, incremental rollers) the seam closing apparatus **300** of the present invention will permit the driven roller **310** to transverse and seal the entirety of the fastseam **100** without requiring the additional time, expense and audible discomfort of a hammering operation.

[0049] Figure 12 illustrates a partial cross-section end view of the seam closing apparatus **300** as it is engaged with the fastseam **100**. As shown in Figure 12, the idler roller **312** includes an annular groove **318** which serves to receive the lower bend **220** (also shown in Figure 2) of the fastseam **100**, thereby ensuring a secure lock upon, and tracking of, the fastseam **100** as the seam closing apparatus **300** is driven down the length of the fastseam **100**.

[0050] It should also be noted that the driven roller **310** includes an angled profile **322** such that, as shown in the cross-sectional view of Figure 12, the circumference of the driven roller **310** is smaller in the area adjacent the seam closing apparatus **300** than it is at the exterior side **324** of the driven roller **310**. In this manner, the eccentrically formed driven roller **310** ensures a tight seal of the sealing portion **120** against the duct wall **216**.

[0051] Figure 13 illustrates the a cross-sectional view of the operation end **308**, including internal gearing comprised of bevel and spur gears for increased power transmission and quiet operation, contained therein. In accordance with another embodiment of the present invention, and as shown in Figure 13, the internal gearing of the seam closing apparatus **300** may be arranged such that the idler roller **312** may also be driven by the (unillustrated) motor contained within the housing **302**. That is, with particular respect to Figures 9-12, the idler

roller **312** may itself be driven along with the drive roller **310**, thus reducing fatigue and increasing closing and travel speed down the length of the fastseam **100**.

[0052] As will be appreciated by consideration of the embodiments illustrated in Figures 3-13, the present invention provides a seam closing apparatus for ducts having a heretofore unknown ease of use and flexibility. Moreover, as is best seen in Figures 5 and 12, the present invention rotatably mounts the drive roller and the idler roller upon differing planar surfaces of the operation end of the seam closing apparatus. As each of these planar surfaces are discontinuous from one another, they provide the appropriate orientation, in a step-like fashion, to accommodate and align the outwardly extending sealing portion and the lower fold of the fastseam.

[0053] The seam closing apparatus of the present invention also advantageously promotes a quicker initial assembly of the ductwork without requiring labor intensive and oftentimes painfully loud hammering operations. Another inherent benefit of the present invention resides in the ability of the seam closing apparatus to transverse the entire length of a given duct seam. These benefits, coupled with the inherent benefits of the fastseam illustrated herein, provide a level of comfort and ease of assembly not previously realized with prior art seam closing systems.

[0054] While the invention has been described with reference to the preferred embodiments, it will be understood by those skilled in the art that various obvious changes may be made, and equivalents may be substituted for elements thereof, without departing from the essential scope of the present invention. Therefore, it is intended that the invention not be limited to the particular embodiments disclosed, but that the invention includes all equivalent embodiments.